TECHNOLOGY NEEDS/OPPORTUNITIES STATEMENT

IMPROVED, REMOTE, IN-SITU DETECTION OF CARBON TETRACHLORIDE IN GROUNDWATER AND THE VADOSE ZONE

Identification No.: RL-SS03
Date: September 2001

Program: Environmental Restoration
OPS Office/Site: Richland Operations Office/Hanford Site
Operable Unit(s): 200-ZP-1, 200-PW-1
PBS No.: RL-CP01 (RL-ER08)
Waste Stream: Groundwater (Disposition Map Designation: ER-10 [technical risk score 5] and ER-18 [technical risk score 5])
TSD Title: N/A
Waste Management Unit (if applicable): N/A
Facility: N/A

***Priority Rating*:**

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" priority:

____ 1. Critical to the success of the ACPC
_X_ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
____ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success.

***Need Title*:** Improved, Remote, In-Situ Detection of Carbon Tetrachloride in Groundwater and the Vadose Zone

Need/Opportunity Category: Technology Need

***Need Description*:** A remote in situ monitoring device is needed for both groundwater and vadose zone (soil gas) monitoring. Monitoring carbon tetrachloride by discrete sampling is costly and time consuming. In situ monitoring is needed to reduce the labor-intensive process of sampling, handling, and shipping samples for analysis. Minimizing or eliminating purge water production and associated disposal or treatment requirements is desired. In situ monitoring is also needed for situations where monitoring site access is difficult and costly (e.g., in restricted areas on site), or where conditions may pose safety hazards to samplers. In situ monitoring is expected to be important for performance monitoring of remediation processes. In situ detection as a part of characterization is needed to provide highly accurate isopleths of contaminant concentrations to aid in fate and transport modeling and construction of remediation systems. In

situ monitoring is also needed to support long term monitoring associated with long-term stewardship of the plume. (Also see Science needs RL-SS33-S, RL-SS34-S, and RL-SS36-S)

Schedule Requirements:

Earliest Date Required: 8/1/99

Latest Date Required: 9/30/30

Groundwater pump and treat and soil vapor extraction systems are presently in operation. An Innovative Technology Remediation Demonstration program is underway to identify potential final remedies. Long-term monitoring will be required to support either continuation of current remediation technologies or alternate technologies.

***Problem Description*:** The central portion of the Hanford Site where the 200 East and 200 West Areas are located was used for chemical separation of plutonium, processing, and waste management. There are two operable units (200-ZP-1 and 200-PW-1) that have been impacted by carbon tetrachloride disposal. Operable unit 200-ZP-1 underlies the northern half of the 200 West Area. The operable unit addresses contamination in the groundwater and saturated zone soils. Source operable unit 200-PW-1 addresses contaminated unsaturated soils associated with Z Plant operations. Contaminants of concern in the operable units are carbon tetrachloride, chloroform, and trichloroethylene. Carbon tetrachloride concentrations of 2,000 - 3,000 ppb occur in the groundwater plume northwest of the Z Plant. Depth to the water table in this area is about 270 feet. A groundwater pump and treat system is in operation at 200-ZP-1 and a vapor extraction system is in operation at 200-PW-1.

At present, concentrations of carbon tetrachloride in groundwater and in soil gas in the vadose zone are measured by discrete sampling from wells with analysis in analytical laboratories (an on-site laboratory is used for soil vapor analysis). Times for receipt of offsite analytical results vary, but can extend to several weeks. Laboratory analytical work is highly accurate, but time delays and high cost associated with sampling and on-site analysis labor are considered to be significant drawbacks. Sampling and analytical waste generated by current methods are other drawbacks adding cost to the monitoring program. In addition to lowering costs, a new monitoring technology that allows measurements at multiple discrete depths within a well will provide for improved plume characterization, better estimates of contaminant inventory, enhanced understanding of plume migration, and better remediation system design.

Benefit to the Project Baseline of Filling Need: An in situ technology would replace the use of laboratory analytical methods and field sampling. At present, these methods are producing satisfactory analytical results but are time consuming and expensive.

***Functional Performance Requirements*:** The new technology must measure contaminant concentrations in situ in groundwater wells, vadose zone wells or potentially in soil gas drive points. Results must be near real-time or on-demand and output must be transmittable by hardwire or telemetry to standard computer connections for data reduction and processing. In situ carbon tetrachloride detection for groundwater should be sensitive to less than 5 ppb.

Carbon tetrachloride detection in the vadose zone soil gas should be sensitive to less than 1 ppmv. In situ detectors must be of robust design and capable of operating for long periods without maintenance in the specified environments. A technology able to make measurements at multiple discrete depths within a well to allow for vertical plume profiling is also desired.

Work Breakdown Structure (WBS) No. : 1.4.03.3.1.02.08.17.01 (200-ZP-1)
1.4. 03.3.1.03.02.25.01 (200-PW-1) ***TIP No.:*** N/A

Relevant PBS Milestone: PBS-MC-029

***Justification For Need*:**

Technical: In situ measurement in extraction, injection or monitoring wells would provide remote monitoring of contaminant concentrations. In situ monitoring may be needed to support cost effective performance monitoring of remediation technologies. Combinations of horizontal and vertical profiling could provide highly accurate isopleths of contaminant concentrations to aid in fate and transport modeling and construction of remediation systems. In situ monitoring will also negate the present requirement of human samplers to purge wells, collect samples and transport to a laboratory, and dispose of waste.

Regulatory: There is no regulatory requirement for this technology need.

Environmental Safety & Health: There are no environmental safety and health issues of concern with this technology need.

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: The estimated life-cycle cost savings associated with filling this need is $3M. This estimate is based on an assumed savings of 30% of the current monitoring cost of $300K/yr over 30 years.

Cultural/Stakeholder Concerns: In situ monitoring could reduce the "traffic" around monitoring locations situated in or near culturally and environmentally sensitive areas.

Other: None.

Current Baseline Technology: Laboratory analysis (an on-site laboratory is used for soil vapor analysis).

Cost: Based on estimates of $1500 sample collection cost per well, $175 per sample analysis cost, and 200 wells sampled once per year, the annual costs for monitoring the CT groundwater plume is approximately $335K per year. The monitoring duration depends on the final remediation strategy but is likely to last for 30 years or more. Although there are no current baseline plans to fund extensive plume mapping, advanced characterization

techniques that allowed near real time monitoring of plume concentration changes would be supported by the groundwater project.

Cost per unit: $1500 sample collection cost per well, $175 per sample analysis.

Waste: None.

How Long It Will Take: Likely 30 years or more

End-User: Richland Environmental Restoration Project

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